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Risk Analysis of Nintendo Co., Ltd

Interactive Qualifying Project

WPI

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10/29/17

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Abstract

The purpose of this paper is to explore investor sentiment and investor risks for the Japanese video game company, Nintendo. Being one of the largest, longest-lasting, and most successful companies in the video game industry, the research into this topic proves to be both historical, topical, and relevant from an industry and financial standpoint.

By observing historical financial data and running different analysis, this paper aims to find correlations between different events in the company's recent history, how investors react to said events, and overall market to determine whether or not any correlation can be derived between them. Using regressions and different financial ratios, correlations between different types of events were proven to be significant and relevant to investor sentiment and the overall market.

In the end, this paper aims to inform about historical sentiment and potential investor strategies for one of the leading companies in the rapidly growing video game industry and can potentially serve as an academic resource on a topic that is both new, relevant, and otherwise lacking a lot of public documentation.

Acknowledgements

Thank you to Professor Koutmos for allowing advising the my project and allowing me to research a topic in which I've always had a long running interest in. I thoroughly enjoyed working under your guidance and the conversations we had throughout the project.

I'd also like to thank my grandfather for teaching me the importance of understanding finance from a young age, as well as my parents for (probably regretfully) purchasing me Nintendo products when I was a child. Without that combination, this project would probably not exist.

1.1 Historical Background

In the western world, Nintendo is widely known for their world-class video game systems and video game franchises featuring some of the strongest intellectual properties in the entire industry. However, before making a name for themselves in America with their Donkey Kong arcade cabinets in 1981, Nintendo had nearly been around for a century. Founded in Kyoto on September 23, 1889, then known as “Nintendo Koppai”. Their roots were always grounded in entertainment, as they quickly gained popularity in Japan for their hand crafted Hanafuda cards, a classic card game in Japan. They continued to be a card game empire for the better half of the century.

Nintendo began a transformation into a more broad range of entertainment and games in 1965, due to the Japanese Economic Miracle. “The society had seen all games as corrupt, only work and seriousness were considered to be virtuous.”, stated Hiroshi Imanishi, Nintendo Managing Director, in a 1994 interview. “However, the economic surge has created new possibilities for structuring one’s free time. From 1965 we had to develop new games to satisfy our customers.”¹

Nintendo soon branched out to become not just a card game company, but an innovative toy pioneer in the years following. Some such toys as the Ultra-Hand and Ultra-Machine were hits, and eventually Nintendo made its way into the arcade amusement industry in 1973 with its popular Laser-Clay Shooting System. The new focus on arcade games would run through the 70’s with low-to-moderate success, until they hit the jackpot with the popularity of Donkey Kong. Donkey Kong became a cultural phenomenon in the peak of the video arcade, and Nintendo followed up its success with more popular games such as Donkey Kong Jr and Mario Bros.

The arcade boom came and went, and the video game market was seeing a huge decline and fell into a recession in 1983. The industry had become oversaturated with low quality titles, a lack of innovation, and ailing consumer trust. There was also the rise and competition from home computers which seemed to be making the Atari systems on the market irrelevant. However, this impact only seemed to be relevant in America as over in Japan in the same year Nintendo had just launched the Family Computer System, its first home videogame console. This console managed to find its way into 6.5 million homes in Japan by 1986, 19% of the population², and Nintendo wished to repeat its success in Japan in the United States.

The Nintendo Entertainment System saw release in 1985 in the United States, and by 1987 had become a national phenomenon. With a relatively cheap starting price of \$179.99, the NES found its way into 30% of American homes by 1990, more than that of the personal computer, as well as all previous game consoles sold combined.³ Nintendo faced little competition and had a near monopoly on the home console market in the United States. However, outside of the United States and Japan, a competitor

¹ Beineix, Jean-Jacques, director. Otaku. France 2 Cinéma, 1994.

² Takiff, Jonathan (June 20, 1986). "Video Games Gain in Japan, Are Due For Assault on U.S.". *The Vindicator*. p. 2.

³ "Fusion, Transfusion or Confusion / Future Directions In Computer Entertainment". *Computer Gaming World*. December 1990. p. 26.

known as SEGA held the largest market share in Europe and South America in 1990 with their SEGA Master System.

SEGA wished to become a challenger in the USA's console market as well, and sought to achieve this by releasing the SEGA Genesis, known as the Mega Drive elsewhere, early in 1989. Using a much stronger hardware with double the graphics and sound capabilities of Nintendo, SEGA launched the 16-bit era of video games in the United States with their console which was competitively priced at \$189.99. While the system didn't have much of an effect on Nintendo's popularity in Japan, SEGA took full advantage of Nintendo's late start to the 16-bit era, eventually claiming to overtake Nintendo's market share of the industry by 1993. The Super Nintendo launched to compete with SEGA's system in 1991, in what came to be known as the "Console Wars", the first time there ever was a strong competition for market share in the United States in the home console industry. While SEGA held most of the market in the early 90s, the Genesis eventually phased itself out with its confusing and expensive add-on consoles, leading the Super Nintendo to eventually outsell the Genesis in its lifetime.⁴

While the home console market was fiercely competitive in the 1990's, one place Nintendo never faced competition was in their revolutionizing of the handheld game market with the Game Boy. Launching in 1989 at a price of \$89.99, the Game Boy offered console quality titles on the go. Its popularity would have it remain on the market until 2003 and sell over 118 million units. While there were attempts from SEGA and Atari to compete, even with their superior hardware, Nintendo's grip over the market would remain dominant. The Game Boy would be followed up by the Game Boy Color, Game Boy Advance, Nintendo DS, and Nintendo 3DS systems and never truly had an industry rival other than the success of the Sony PSP in 2005. However, even with over 80 million units sold for Sony, the Nintendo console at the time, the DS, surpassed 150 million units. Some would argue that the advent of the smartphone became a direct competitor to Nintendo's handheld console market, but even then the Nintendo 3DS, their latest handheld, has surpassed 67 million units sold in its lifetime.⁵

Returning back to the console market, although Nintendo was able to regain its market share lead in the USA around 1994, the next wave of consoles and hardware capabilities arrived in 1994 with Sony's Playstation. Once again a competitor in the market sought to capitalize on Nintendo's late entry into the next generation of hardware and had much success. The Playstation dominated Nintendo worldwide selling over 100 million units in its lifetime with its popularization of disc based consoles allowing for larger more graphically advanced software. Nintendo eventually released their Nintendo 64 cartridge based system in 1996, hoping its classic franchises could help it compete directly with Sony. However, the console only managed just over 32 million units sold worldwide and was even outpaced in sales by SEGA's SEGA Saturn game console in Japan.

Nintendo, less than a decade ago was alone at the top with over 90% of the market in the United States to start the 90's. However, at the turn of the century, the company saw its position of dominance nearly vanish, and even with the demise of SEGA's hardware, Nintendo saw a new competitor in

⁴ Pachter, Michael; McKay, Nick; Citrin, Nick (February 11, 2014). "Post Hoc Ergo Propter Hoc; Why the Next Generation Will Be as Big as Ever". *Wedbush Equity Research*. p. 36.

⁵ "Consolidated Financial Highlights" (PDF). Nintendo. July 26, 2017. p. 8.

Microsoft with their Xbox system. The next Nintendo console, the Gamecube, continued the company's trend of being the least popular console on the U.S. market being outsold by the Xbox and Sony's Playstation 2, which went on to become the top selling console of all time.

Reaching a point of desperation, Nintendo sought to reclaim the throne on the console market with a new approach, something never seen in the gaming world. Nintendo shifted its focus from competing directly with the competition, to entering its own market. In 2006, Nintendo released the much anticipated Nintendo Wii. The console which was dubbed the Nintendo Revolution during development, caused just that. The Nintendo Wii became a global craze. With its unique motion controls, extremely affordable price of \$250, and great marketing, Nintendo saw the greatest success in the company's long 127 year history. Stock prices rose to an all time high which would last until the market crash in 2008, and once again, Nintendo became the household name it once was in the late 80's again. The Wii went on to outsell all competing products on the market surpassing 100 million lifetime sales.

Following the market crash in 2008, Nintendo's value never reached its previous high in the market, and value continued to diminish with the Wii's days of popularity and high volume of sales eventually fading away leading into 2012. Nintendo entered the next generation of console trying to continue the popularity of the Wii, with its Wii U console. However, due to a confusing name, and a consumer market that just seemed to be tired of the Wii brand, this console became one of Nintendo's worst flops. Selling even less than the Gamecube at just over 13 million units in its lifetime, Nintendo's stock reached a 10-year low with some of their worst financial losses in their modern history. The console was quickly outpaced by the the Xbox One and PS4.

This once again led Nintendo to a point of desperation in an attempt to recapture both its audience and the trust of its investors. In 2015 Nintendo sought to strengthen its IP and increase their brand appeal. With much hesitation, a deal was eventually struck with DeNA for Nintendo to enter the mobile market something that was long desired from investors and was much resisted by Nintendo.⁶ Nintendo also announced they were working on a new gaming device that would once again create a unique gaming experience as the Wii had just 10 years prior.

This leads to modern day, 2017, when Nintendo finally released the Nintendo Switch, a hybrid home-portable console. Although there was much speculation and distrust with the system's potential, it went on to become Nintendo's fastest selling console ever.⁷ While the console is still brand new and has just entered the beginning of its life-span, Nintendo has reported that the console is currently on pace to match, if not surpass the sales of the Wii, leading Nintendo to once again claim relevance in the market, and promise among shareholders.⁸ Currently the console sits just under 5 million units sold only half a year into its lifetime.

⁶ Wingfield, Nick (January 18, 2014). "Resisting Mobile Hurts Nintendo's Bottom Line". *New York Times*.

⁷ Titcomb, James (March 7, 2017). "Switch is 'fastest-selling console in Nintendo's history'". *The Daily Telegraph*.

⁸ Brightman, James (May 2, 2017). "Nintendo now believes Switch can reach Wii sales levels". *GamesIndustry.biz*.

1.2 Investor Sentiment

Investor sentiment with Nintendo has been mixed throughout the year, especially with western investors. Although an innovative, bright, and creative game company known for being family-friendly and timeless, Nintendo at its heart is a very conservative Japanese company. While product innovation has always been their selling point, they have shown stubbornness to adapt to change that wasn't created by themselves. Collaboration with other companies in the industry historically has been limited or fallen through due to their strong, "do it ourselves better than anyone else" mantra. This was never more apparent than with the previously stated refusal to allow their IP to appear on smartphone devices, as they feared doing such would cause the company to lose their identity.

Investors have often been seemingly careful with investments in Nintendo prior to the release of a console due to their seemingly hit-or-miss nature of sales, and the growing competition in the 2000's, and refusal to adapt to what shareholders desired to see from the company.

However, since 2015 investor sentiment has seemingly changed for the better with Nintendo as Nintendo has seemed to change their stance on many of their conservative values. In 2015, Nintendo finally announced that it would begin cooperation with mobile game developers to release spin-off titles of their IP, such as Mario and Animal Crossing, to smartphone devices. As of fall 2017, Nintendo has released three first party mobile game titles and collaborated with their second-party company, The Pokemon Company, for the release of Pokemon Go. The announcement and release of their mobile titles has caused a rise in Nintendo stock prices every time, however, usually decline shortly after as Nintendo still insists on using their own pricing strategies as a means of principle. For example, the release of Super Mario Run, saw Nintendo's stock rise, but fall, as the game only required a one time purchase as opposed to the more popular "free-to-play" pricing strategy which allows users to start the game for free, but has the potential for endless profits due to in-game transactions required to progress.

To go along with the change in heart on mobile games, Nintendo also has shown signs of more collaboration with other entertainment and game companies in hopes of broadening appeal of their IP. Such collaborations included limited exclusivity with Apple and an appearance at the Apple Conference in 2016 for Super Mario Run, as well as the creation of a Nintendo portion of Universal Studios Theme Parks worldwide. Nintendo has also released much more merchandise than ever before as well as smaller game consoles that harken to past nostalgia such as the NES Classic and SNES Classic, to increase brand popularity, IP strength, and appease investors with their rejuvenated interest in becoming, not only a game industry empire, but a cultural empire.

Thus far their new marketing and release strategies have been a success with investors since 2015 as stock prices are currently at a 10-year-high as of Fall 2017.

1.3 Market Strategy

Nintendo has always been unique in its marketing. True to its conservative Japanese industry nature, Nintendo, in the heart of it all, has always stayed true to its roots as a classic toy and game company. In a world where most game console marketing is focused on graphical power and crossovers with other strong IP, Nintendo has been in a world of its own, even back when it was in a graphical arms race with SEGA in the 90's. Nintendo always presented their hardware as if it is a toy. "Look what you can do with our console" is always the feeling you get from their console design and marketing as opposed to "Look what our console can do" that you see from competitors that see consoles as more of multimedia machines. A very toymaker approach and mindset. Whether it was robot partner, motion controls, light guns, or consoles that you can instantly turn into tablets, Nintendo has always marketed their products, at a fundamental level, the same way you'd see toys marketed towards children. There's always some sort of movement, or unique gimmick that makes their consoles seem alive, versatile, and one-hundred-percent undoubtedly Nintendo.

In a sense, Nintendo tries not to see any other consoles on the market as a competitor. They believe they are in their own market, a market where only Nintendo exists. "We try not to see the other companies as competition," stated Shigeru Miyamoto, creator of Super Mario Brothers, "we are only concerned with the quality of the new game when compared with the old ones."⁹ This was from an interview back in 1994, but even today this sentiment still rings true. "The 'Nintendo Strategy', the 'Nintendo Difference' of seeking out new ways of delivering fun, immersive, entertaining experiences to consumers is the right strategy and that's what we'll continue to do..." says Reggie Fils-Aime, President of Nintendo of America, in a 2011 interview prior to the launch of the Nintendo 3DS¹⁰

Outside of their presentation of their hardware, it is just as important for Nintendo to market their software. Nintendo owns some of the strongest IP in the industry and is well aware of this fact. Their IP is so strong that they are able to move millions of units of systems on the promise of Mario or Zelda alone. Nintendo has usually used its dynamic of handheld and console games together to strengthen their IP. If someone owned a Game Boy, for example, they can become familiar with Mario through the Super Mario Land series, and then look and see the color and scope of Super Mario World on the Super Nintendo and wish to own that console too. Inversely, someone who owned a Super Nintendo and played a lot of Super Metroid, could look at Metroid II on the Game Boy and purchase the system and game for the desire of playing it on the go. This synergy between handheld and home console gaming has been used to, in a sense, cross-pollinate the users from both their products and build brand loyalty through the quality of both.

Nintendo, alongside the games themselves, has marketed their products with merchandise, tv shows and advertisements, product placement, and other common strategies used by major entertainment companies. There's also plans for a Nintendo theme park in Universal Japan to open up prior to the 2020

⁹ Beineix, Jean-Jacques, director. Otaku. France 2 Cinéma, 1994.

¹⁰ Youtube, "Nintendo President Reggie Fils-Aime on Competition and Annual Business" Online Video Clip, July 11, 2011. *Youtube*

Olympics, and Mario was featured in the promotional video for the global event, showing that the Mario franchise is at a point of global brand recognition.

Nintendo also sees its new mobile gaming experiences as marketing experiences as well. They have been using the large install base of smartphones to bring attention to their IPs such as Mario and Fire Emblem with smaller sample sizes of their IP and what is available on their featured consoles the Switch and 3DS. With the booming popularity of the Switch, and one of the most successful years for Pokemon ever following the release of Pokemon Go, it would seem using smartphones as a marketing platform has been a great success for the company and finally adapting to a less conservative and stubborn company has proven great results for the time being.

2.1 Evolution of the Industry

The game industry as a whole has undergone a unique evolution in the past three decades. What was once seen in the same light as toys or rather juvenile hobbies has now become a global multi-billion dollar empire that spans all forms of media. The average age of someone who plays games is around 35 as of 2016, and games are more accessible than ever to play and to create. Gaming has become its own mainstream culture, and a global part of everyday life. Competitive gaming for example is on pace to become a multi-billion dollar industry by 2019.¹¹

The major growth of the industry to reach this point in sales and culture can be attributed to starting in the early 2000's in the PS2, Gamecube, and Xbox era. By this point in time, those who had grown up playing NES have reached adulthood, and are potentially having children of their own. This also means that adults are now widely considering buying game consoles not only for children, but for themselves as well for the first time on a mainstream level. More mature and realistic games started appearing as a result of the older user base. Also, with the increased technology capabilities, games could now be used as a multimedia platform. The PS2 and Xbox were both compatible with DVDs and rose to popularity as not just a gaming machine, but a home video device too. With an older audience, flexibility, and accessibility like never before, games have finally settled in as a mainstream hobby for all ages.

The size and strength of the industry would only increase heading into the 2000's especially with the Wii. As gamers got older, so did their kids and thus more opportunity to normalize and familiarize a wider age range with video games like never before. The Wii's popularity in 2006 also managed to transcend the gaming market as well. It's motion controls, price, and accessibility introduced a whole new market of non-gamers into video games, and even converted people who never played games before in their life to the hobby. Reports of elderly people playing the Wii in retirement homes flooded the news and the rise of video streaming services such as Netflix allowed the Wii and other consoles to increase their multimedia capabilities. Game consoles had reached a point where it was completely integrated into everyday life.

¹¹ Riddell, Don. "ESports Revolution Is Right Here, Right Now." *CNN*, Cable News Network, 29 May 2016, www.cnn.com/2016/05/29/sport/esports-revolution-revenue-audience-growth/index.html.

This leads into the time of this report, where not much has changed aside from the industry becoming more valuable by the day. Due to the dramatic cultural change in the video game industry, while starting the modern three competing console market place, the focus of analysis in this report will begin in 2001 as it is the best starting point to represent the modern video game industry.

3. Methodological Framework

To further explore investor sentiment of Nintendo to the overall market, this paper will look into four key indicators, firm specific volatility, market volatility, Sharpe ratio, and Treynor ratio. The prior two options will be used to measure how investors see Nintendo's overall value compared to the trends in the market and if Nintendo is more or less volatile than the market. The later two will explore the risk-to-return sentiment on the company during different key dates in their recent history to observe what events provide a larger return investment for investors.

3.1.1. Firm Specific Volatility

Nintendo Vol Level								
<i>Regression Statistics</i>								
Multiple R	0.024708035							
R Square	0.000610487							
Adjusted R Square	0.000425278							
Standard Error	2.615499114							
Observations	5398							
<i>ANOVA</i>								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>gnificance F</i>			
Regression	1	22.5487625	22.54876	3.29620002	0.069496			
Residual	5396	36913.14899	6.840836					
Total	5397	36935.69775						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>pper 95.0%</i>
Intercept	0.010382401	0.047446292	0.218824	0.8267952	-0.08263	0.103396	-0.08263	0.103396
X Variable 1	0.008272657	0.004556572	1.815544	0.06949583	-0.00066	0.017205	-0.00066	0.017205

Figure 1.1: The regression firm-specific volatility (X) to the returns of the company (Y) of Nintendo since September 20th, 1995.

The interpretation of the regression analysis for Nintendo's firm specific volatility seem to indicate a slight lack of correlation between the company's volatility to the actual returns of the company. More interesting however, is the P-value of the data proving to be significant meaning from the gathered

data, one cannot reject the null hypothesis of the volatility and returns of the company having no statistical correlation.

In order to gather significant data on firm specific volatility, the volatility shock for the company was also calculated and put into a regression against the returns.

Nintendo Vol Shock								
Regression Statistics								
Multiple R	0.155498377							
R Square	0.024179745							
Adjusted R Square	0.02399887							
Standard Error	2.584551975							
Observations	5397							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>gnificance F</i>			
Regression	1	892.9844212	892.9844	133.682125	1.47E-30			
Residual	5395	36038.10857	6.679909					
Total	5396	36931.09299						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>lower 95.0%</i>	<i>pper 95.0%</i>
Intercept	0.043359658	0.035240096	1.230407	0.21859841	-0.02573	0.112444	-0.02573	0.112444
X Variable 1	0.02017815	0.001745198	11.5621	1.466E-30	0.016757	0.023599	0.016757	0.023599

Figure 1.2: Regression of volatility shock (Y) to Nintendo share price returns (X) since September 20th, 1995.

From the volatility shock regression data, one can infer that there is a significant correlation between the shock and the returns. That this means is that during time spans when investors see little movement or a low-point in volatility in Nintendo's stock, they tend to become much more aggressive. Thus from this collected data, we can conclude that investors are more likely to sell or invest in Nintendo shares during stretches where there has been consistency within the stock's value. Whether an investor buys or sells during this time is likely due to their sentiment on the company's direction and overall market confidence.

3.1.2. Market Volatility

To access the relation of market volatility to Nintendo's returns a comparison between one of Nintendo's largest success in its history, the Nintendo Wii, and one of its largest failures, the Nintendo Wii U, will be made to see if market volatility has more of an impact on if the company is succeeding or in a negative time period. Also, regressions will be performed between both the Japanese market indicators, due to the company being of Japanese origins and due to that market being heavily influenced by U.S. market indicators, which is Nintendo's largest market.

SUMMARY OUTPUT								
Regression Statistics								
Multiple F	0.578368204							
R Square	0.334509779							
Adjusted	0.333603117							
Standard Error	2.553589092							
Observations	736							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	2405.831623	2405.8316	368.9463	6.29E-67			
Residual	734	4786.279862	6.5208173					
Total	735	7192.111486						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.132970203	0.094158253	1.4121991	0.158315	-0.05188	0.317822	-0.05188	0.317822
X Variable	0.879508426	0.04578871	19.207976	6.29E-67	0.789616	0.969401	0.789616	0.969401

Figure 2.1: Regression of Nintendo Stock (Y) to Nikkei 225 (X) from 5/19/2006-5/19/2009

This regression utilizes a 3-year data set of May 19, 2006, 6-months prior to the launch of the Wii, until 3 years after that date. In this period of time, the Nintendo's financial returns can be accessed as having significant correlation to the returns of the overall Japanese market. The X-coefficient also displays that Nintendo's volatility is slightly less than the overall Japanese market during this period of time

SUMMARY OUTPUT								
Regression Statistics								
Multiple F	0.46345356							
R Square	0.214789202							
Adjusted	0.213183454							
Standard Error	2.157118255							
Observations	491							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	622.4191549	622.41915	133.7627	1.63E-27			
Residual	489	2275.394832	4.6531592					
Total	490	2897.813987						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-0.02008515	0.097588711	-0.2058143	0.837022	-0.21183	0.17166	-0.21183	0.17166
X Variable	0.759879328	0.065701776	11.565583	1.63E-27	0.630787	0.888972	0.630787	0.888972

Figure 2.2: Regression of Nintendo Stock (Y) to Nikkei 225 (X) from 5/18/2012-5/19/2014

This specific regression displays the financial analysis for the major lifespan of the Wii U console. The data set is smaller due to the console having a shorter lifespan, and the company changing initiatives in 2015 which impacted their share value and were not indicative of their hardware at the time.

The regression for this console and time-span show slight changes to investor behavior but, is overall relatively similar to the behavior of returns during the Wii's lifespan. The only key difference is that the company was slightly less volatile than the market during this time, because even though the Japanese market saw significant rise during this time span, Nintendo's value stagnated and even decreased frequently during this time due to dramatic failure of their hardware and an uncertain future direction for the company.

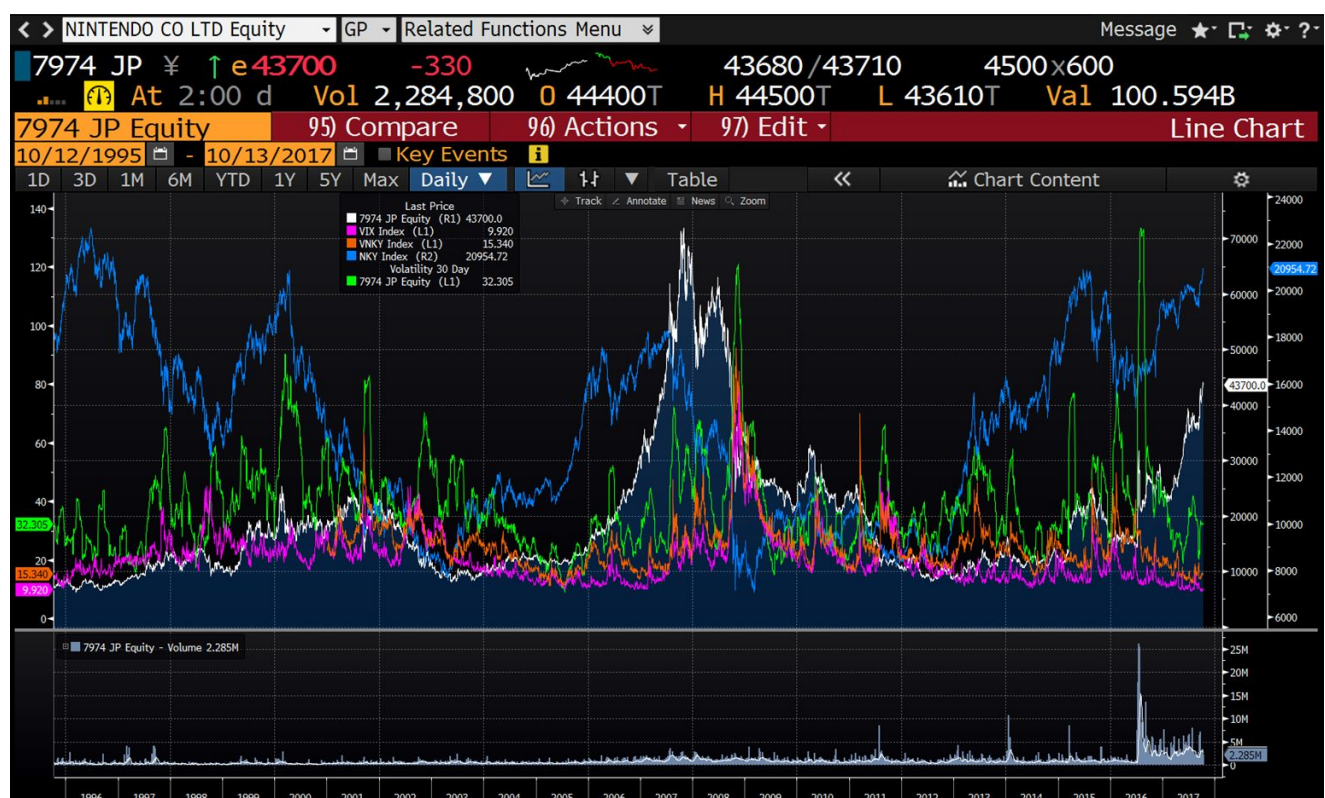


Figure 2.3: Nintendo historical value (White) since 9/20/1995 compared with its volatility (Green), Nikkei 225(Blue), Nikkei 225 Volatility(Orange), and S&P500 Volatility(Purple).

3.1.3. Sharpe Ratio

Sharpe ratio is one of the measures that will be utilized to observe the risk-free Risk-to-Return investment on Nintendo during the course of set periods of time that are deemed significant since 2000. Selected time periods will be 6-months prior to 6-months following hardware launch and major mobile gaming related announcements and releases.

Sharpe Pre-Cube	Sharpe Post-Cube	Sharpe Pre-Wii	Sharpe Post-Wii	Sharpe Pre-Wii U
Mean	Mean	Mean	Mean	Mean
-0.081435269	0.256483599	0.243348235	0.411456685	0.101425968
Std.Dev	Std.Dev	Std.Dev	Std.Dev	Std.Dev
2.916536806	3.301214799	2.123945718	2.047038721	1.986361032
Sharpe	Sharpe	Sharpe	Sharpe	Sharpe
-0.027921907	0.077693702	0.11457366	0.201000929	0.051061195
Sharpe Post-Wii U	Sharpe Pre-Switch	Sharpe Post-Switch	Sharpe Pre-DS	Sharpe Post-DS
Mean	Mean	Mean	Mean	Mean
0.083621823	0.013754563	0.39850533	0.155753578	-0.025958357
Std.Dev	Std.Dev	Std.Dev	Std.Dev	Std.Dev
2.595228694	2.617512662	1.88221071	1.694723497	1.338796765
Sharpe	Sharpe	Sharpe	Sharpe	Sharpe
0.032221369	0.005254822	0.211721954	0.077693702	-0.019389318
Sharpe Pre-3DS	Sharpe Post-3DS	Mobile Announcement	Pokemon Go Sharpe	Mario Run Sharpe
Mean	Mean	Mean	Mean	Mean
0.070199084	-0.510120543	2.229588961	3.316502001	-0.67888486
Std.Dev	Std.Dev	Std.Dev	Std.Dev	Std.Dev
1.700194816	2.727292848	6.924570464	10.39019406	3.013219576
Sharpe	Sharpe	Sharpe	Sharpe	Sharpe
0.041288847	-0.187042819	0.321982276	0.319195386	-0.225302154

Figure 3.1: Sharpe Ratios for all major pre-releases and post-releases for Nintendo consoles, handhelds, and mobile related launches

The Sharpe ratio data tends to show some consistent trends among all major console launches and mobile releases. Primarily, all pre-launch timeframes, 6 months priors, tend to display small amounts of risk-to-return in anticipation to release. The highest Sharpe ratio pre-release was for the Nintendo Wii which had a lot of anticipation surrounding the console, so it had a Risk-to-Return of 11.46% prior to launch. The Gamecube was the only to display a negative return prior to the launch of the console which may be due to the underwhelming performance of the Nintendo 64, Microsoft entering the console market, and less value in the game industry at this time than any other observed.

After the launch of consoles, a similar trend occurs. This trend shows that the risk-to-return for three of the four major console launches tends to increase a significant amount meaning that trading

becomes more volatile and with more potential returns after the launch of a system, rather than prior. The only outlier here is the Wii U in which the risk-to-return decreased which can be due to the console's dismal sales numbers. However, it still maintained a positive ratio. The ratio also appears to be determined after launch by initial company sales numbers, as the fastest selling launch, the Nintendo Switch shows the largest growth, followed by the second-largest Wii, then the Gamecube, and then the Wii U, which is in descending order of their initial 6-month success.

For the company's handhelds, DS and 3DS, there appears to be an inverse relationship. While prior to a handheld launch shows a positive return-to-risk ratio, 6 months following the release displays a negative relationship. This at first may appear odd because Nintendo is the only real major player in that market and its systems have had long lifecycles and success in sales. However, the initial negative return may be due to both handhelds having a gradually increasing success and not initial launch success. Both of the consoles had relatively rough launches, but sales tended to pick up a year or two into its lifecycle due to a growing library of titles and different, cheaper models becoming available.

Mobile gaming is the most interesting however. Investors had been urging Nintendo to enter the mobile market for years, and when they finally announced they were doing such in 2015, investors reacted. Out of all the data collected, the announcement of mobile titles by Nintendo yielded the largest risk-to-return ratio at 32.198%. This is followed by the release of Pokemon Go which netted a ratio of 31.92%. The release of this title actual had Nintendo's largest return percentage increase since the Nintendo Entertainment System, but investors quickly pulled out a few days later after learning that Nintendo did not hold full ownership of the title.

Super Mario Run's launch broke the trend of mobile success coming in with the largest negative returns of all the time periods observed. This could have been due to the low-sales of the title and investors not being pleased with its pricing platform being more traditional and not taking advantage of the "Free-to-Play" pricing standard in most mobile titles which allows for players to purchase an unlimited number of in game items. Other factors could be due to it releasing in December and Nintendo having a weak holiday season in comparison to others and the typical drop in share prices that occur in the month of December.

3.1.4. Treynor Ratio

Looking at the Treynor ratio will be another method of analyzing to Risk-to-Return ratio using the same time-periods as the Sharpe ratio. However, the Treynor ratio adds in overall market risk to the equation which will help display if some return is only large due to having a similar unit of risk as the market.

Treynor Pre-Cube	Treynor Post-Cube	Treynor Pre-Wii	Treynor Post-Wii	Treynor Pre-Wii U
Mean	Mean	Mean	Mean	Mean
-0.081435269	0.256483599	0.243348235	0.411456685	0.101425968
Beta	Beta	Beta	Beta	Beta
0.585907225	0.647947023	0.146838153	0.675608358	0.959060041
Treynor	Treynor	Treynor	Treynor	Treynor
-0.13899004	0.395840385	1.657254812	0.609016571	0.105755598
Treynor Post-Wii U	Treynor Pre-Switch	Treynor Post-Switch	Treynor Pre-DS	Treynor Post-DS
Mean	Mean	Mean	Mean	Mean
0.083621823	0.013754563	0.39850533	0.155753578	-0.025958357
Beta	Beta	Beta	Beta	Beta
0.622603982	0.615942543	0.44081493	0.291398023	0.866314589
Treynor	Treynor	Treynor	Treynor	Treynor
0.13430981	0.022330919	0.904019584	0.534504581	-0.029964123
Treynor Pre-3DS	Treynor Post-3DS	Mobile Announcement	Pokemon Go Treynor	Mario Run Treynor
Mean	Mean	Mean	Mean	Mean
0.070199084	-0.510120543	2.229588961	3.316502001	-0.67888486
Beta	Beta	Beta	Beta	Beta
0.705637895	0.717851944	1.543468662	4.174758351	1.478751542
Treynor	Treynor	Treynor	Treynor	Treynor
0.099483155	-0.710620829	1.444531409	0.794417718	-0.459093256

Figure 3.2: Treynor Ratios for all major pre-releases and post-releases for Nintendo consoles, handhelds, and mobile related launches

The Treynor ratio data shows relatively similar relationships as the Sharpe ratio data. However, there are a few key indicators of note that show the impact of the overall market risk on some data points. While three of the four pre launches increase in return ratio after launch for the consoles, instead of the Wii U decreasing after release, it is instead the original Wii. This is because in the 6-month timespan prior to the Wii's release, the Nikkei 225 hit a major downward shock and lost a far amount of value (See Figure 2.3) However, the Nintendo share price continued to rise despite this due to the high anticipation of the Wii in overseas markets. Thus, the return per unit of risk is the largest out of all the data points as even though the market was incredibly risky during that time, Nintendo's stock continued to pay rewards.

The only other time that an over 100% return compared to unit of market risk occurs is during the announcement of mobile games being in development and that was during a rising market.

4. Major Findings

The major takeaways from the observed data confirmed previous notions of investor sentiment prior to analysis. First, observing the firm-specific volatility displayed a lack of correlation between stock returns and the volatility. An observation from this came from looking into the volatility shock which showed that investors, since 1995, tend to wait for Nintendo to reach points in which there is little movement before choosing to invest or sell stocks. These moments of little volatility tend to appear during the middle of a major console's lifespan which goes to show that the company stock prices are only volatile and show any sort of momentum during times where Nintendo announces and releases future products and lasts for only about a year or two after that.

Comparing Nintendo's stock to the overall Japanese market showed that the company is not a unique stock and tends to follow the market trends of the Nikkei 225 regardless of whether or not its current gaming console is a failure or massive success. Once again, the only time the company's share price seems to show any individuality or movement outside of the overall market are during periods of time in which the company announces or releases a new major product.

The Sharpe and Treynor Ratio analysis are a little more insightful in terms of representing company risk and investor sentiment. First of all, investors tend to show little reaction and investment risk appears to be significantly miniscule leading up to a console release. This shows that Nintendo is a relatively safe investment during this period of time and rather risk-averse. Once a major console is released the trend is always, at least close to, but usually more, return per risk on investment. The major takeaway from this is that Nintendo, in the past four cases, is a safe and typically rewarding investment if you invest in company shares 6-months prior to a console release. Even in the case of the Wii U, which was a commercial failure, the average return stayed positive.

On the other hand, it does not seem smart to invest in the company prior to the release of their handheld gaming devices. The past two iterations had poor initial sales and the trend throughout company history is a slow early adopter rate, that increases dramatically over a longer span of time than the console market. Whether it is actually a response to the initial slow success, or investors believing that mobile phones are a direct competitor to the Nintendo handheld gaming console lines are factors that could indicate why this occurs.

Lastly, there's the case of mobile games. Investors had been clamoring for Nintendo to enter that market for many years, and when they finally did, investors didn't hesitate in investing in the company at least for the short-term. In fact, it could be argued that investor reaction and sentiment is even stronger than that of Nintendo's most successful console ever, the Wii, displaying how strongly investors feel about the mobile market over traditional gaming platforms. However, while the initial returns when Nintendo announces a mobile product are high, the risk is also substantially large, and so far the trend

with Nintendo mobile products has been a sharp increase in company share prices for a few weeks, followed by a rapid decrease displaying the large risk payoff. Also, in Super Mario Run's case, the project was a commercial disappointment from a sales and investor sale point, leading to large negative risks around the time of its release. It will be interesting to monitor the effects on share prices of major mobile releases going forward. One future case being their next mobile title from the Animal Crossing series, which is releasing during the 2017 holiday season which is projecting to be one of Nintendo's strongest in over a decade. This will be a good measure of how strongly mobile title affect the price of Nintendo stock during a rising economy for both the country and the company.

5. Conclusion

Nintendo has been a staple and innovator in the gaming industry ever since the industry began its rapid growth in the 1980's. Being there from the start has given the company a significant edge in market and brand recognition, as well as being able to span generations of people and touch the lives of many in a way that only entertainment empires like Disney can rival. Because of this, Nintendo's future and success is important to the entire game industry as a whole as they serve as a benchmark.

Nintendo will always continue to do its own thing. Innovate and create new means of gameplay and market them in such ways that they almost seems like their concept was imagined in Santa's workshop. But behind that is a conservative, over a century-year-old multi-million dollar company that's stubbornness and desire to do things the "Nintendo-way" throughout their existence has proven to be the bane of shareholders.

Nintendo always sees success with its consoles, and even its failures are able to captivate a large enough audience to maintain some value. Even when the impact of successfully appeasing investors by adapting to more modern methods of profit in the game industry show dramatic positive returns, Nintendo won't always proceed that way. Marching to the beat of its own drum, and creating Nintendo quality content that seeks to innovate and excite on their own time. That's been the company standard for the past hundred years and will continue to be so for the foreseeable future. Just like the gadgets it creates, Nintendo's approach to business proves to be a unique enigma, and even when it's failing, will always be relevant.

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7. Appendix

Nintendo Vol Level								
<i>Regression Statistics</i>								
Multiple R	0.024708035							
R Square	0.000610487							
Adjusted R Square	0.000425278							
Standard Error	2.615499114							
Observations	5398							
<i>ANOVA</i>								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>gnificance F</i>			
Regression	1	22.5487625	22.54876	3.29620002	0.069496			
Residual	5396	36913.14899	6.840836					
Total	5397	36935.69775						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>lower 95.0%</i>	<i>pper 95.0%</i>
Intercept	0.010382401	0.047446292	0.218824	0.8267952	-0.08263	0.103396	-0.08263	0.103396
X Variable 1	0.008272657	0.004556572	1.815544	0.06949583	-0.00066	0.017205	-0.00066	0.017205

Figure 1.1: The regression firm-specific volatility (X) to the returns of the company (Y) of Nintendo since September 20th, 1995.

Nintendo Vol Shock								
<i>Regression Statistics</i>								
Multiple R	0.155498377							
R Square	0.024179745							
Adjusted R Square	0.02399887							
Standard Error	2.584551975							
Observations	5397							
<i>ANOVA</i>								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>gnificance F</i>			
Regression	1	892.9844212	892.9844	133.682125	1.47E-30			
Residual	5395	36038.10857	6.679909					
Total	5396	36931.09299						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>lower 95.0%</i>	<i>pper 95.0%</i>
Intercept	0.043359658	0.035240096	1.230407	0.21859841	-0.02573	0.112444	-0.02573	0.112444
X Variable 1	0.02017815	0.001745198	11.5621	1.466E-30	0.016757	0.023599	0.016757	0.023599

Figure 1.2: Regression of volatility shock (Y) to Nintendo share price returns (X) since September 20th, 1995.

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.578368204							
R Square	0.334509779							
Adjusted R Square	0.333603117							
Standard Error	2.553589092							
Observations	736							
<i>ANOVA</i>								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	2405.831623	2405.8316	368.9463	6.29E-67			
Residual	734	4786.279862	6.5208173					
Total	735	7192.111486						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.132970203	0.094158253	1.4121991	0.158315	-0.05188	0.317822	-0.05188	0.317822
X Variable	0.879508426	0.04578871	19.207976	6.29E-67	0.789616	0.969401	0.789616	0.969401

Figure 2.1: Regression of Nintendo Stock (Y) to Nikkei 225 (X) from 5/19/2006-5/19/2009

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.46345356							
R Square	0.214789202							
Adjusted R Square	0.213183454							
Standard Error	2.157118255							
Observations	491							
<i>ANOVA</i>								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	622.4191549	622.41915	133.7627	1.63E-27			
Residual	489	2275.394832	4.6531592					
Total	490	2897.813987						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	-0.02008515	0.097588711	-0.2058143	0.837022	-0.21183	0.17166	-0.21183	0.17166
X Variable	0.759879328	0.065701776	11.565583	1.63E-27	0.630787	0.888972	0.630787	0.888972

Figure 2.2: Regression of Nintendo Stock (Y) to Nikkei 225 (X) from 5/18/2012-5/19/2014



Figure 2.3: Nintendo historical value (White) since 9/20/1995 compared with its volatility (Green), Nikkei 225(Blue), Nikkei 225 Volatility(Orange), and S&P500 Volatility(Purple).

Sharpe Pre-Cube	Sharpe Post-Cube	Sharpe Pre-Wii	Sharpe Post-Wii	Sharpe Pre-Wii U
Mean	Mean	Mean	Mean	Mean
-0.081435269	0.256483599	0.243348235	0.411456685	0.101425968
Std.Dev	Std.Dev	Std.Dev	Std.Dev	Std.Dev
2.916536806	3.301214799	2.123945718	2.047038721	1.986361032
Sharpe	Sharpe	Sharpe	Sharpe	Sharpe
-0.027921907	0.077693702	0.11457366	0.201000929	0.051061195
Sharpe Post-Wii U	Sharpe Pre-Switch	Sharpe Post-Switch	Sharpe Pre-DS	Sharpe Post-DS
Mean	Mean	Mean	Mean	Mean
0.083621823	0.013754563	0.39850533	0.155753578	-0.025958357
Std.Dev	Std.Dev	Std.Dev	Std.Dev	Std.Dev
2.595228694	2.617512662	1.88221071	1.694723497	1.338796765
Sharpe	Sharpe	Sharpe	Sharpe	Sharpe
0.032221369	0.005254822	0.211721954	0.077693702	-0.019389318
Sharpe Pre-3DS	Sharpe Post-3DS	Mobile Announcement	Pokemon Go Sharpe	Mario Run Sharpe
Mean	Mean	Mean	Mean	Mean
0.070199084	-0.510120543	2.229588961	3.316502001	-0.67888486
Std.Dev	Std.Dev	Std.Dev	Std.Dev	Std.Dev
1.700194816	2.727292848	6.924570464	10.39019406	3.013219576
Sharpe	Sharpe	Sharpe	Sharpe	Sharpe
0.041288847	-0.187042819	0.321982276	0.319195386	-0.225302154

Figure 3.1: Sharpe Ratios for all major pre-releases and post-releases for Nintendo consoles, handhelds, and mobile related launches

Treynor Pre-Cube	Treynor Post-Cube	Treynor Pre-Wii	Treynor Post-Wii	Treynor Pre-Wii U
Mean	Mean	Mean	Mean	Mean
-0.081435269	0.256483599	0.243348235	0.411456685	0.101425968
Beta	Beta	Beta	Beta	Beta
0.585907225	0.647947023	0.146838153	0.675608358	0.959060041
Treynor	Treynor	Treynor	Treynor	Treynor
-0.13899004	0.395840385	1.657254812	0.609016571	0.105755598
Treynor Post-Wii U	Treynor Pre-Switch	Treynor Post-Switch	Treynor Pre-DS	Treynor Post-DS
Mean	Mean	Mean	Mean	Mean
0.083621823	0.013754563	0.39850533	0.155753578	-0.025958357
Beta	Beta	Beta	Beta	Beta
0.622603982	0.615942543	0.44081493	0.291398023	0.866314589
Treynor	Treynor	Treynor	Treynor	Treynor
0.13430981	0.022330919	0.904019584	0.534504581	-0.029964123
Treynor Pre-3DS	Treynor Post-3DS	Mobile Announcement	Pokemon Go Treynor	Mario Run Treynor
Mean	Mean	Mean	Mean	Mean
0.070199084	-0.510120543	2.229588961	3.316502001	-0.67888486
Beta	Beta	Beta	Beta	Beta
0.705637895	0.717851944	1.543468662	4.174758351	1.478751542
Treynor	Treynor	Treynor	Treynor	Treynor
0.099483155	-0.710620829	1.444531409	0.794417718	-0.459093256

Figure 3.2: Treynor Ratios for all major pre-releases and post-releases for Nintendo consoles, handhelds, and mobile related launches